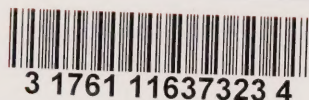


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Socio-economic Series 05-008

EVALUATING ARTERIAL ROAD CONFIGURATION OPTIONS FOR A NEW COMMUNITY

INTRODUCTION

The Manitoba Housing and Renewal Corporation (MHRC) owns approximately 1,200 acres (148 ha) in the north sector of the Waverley West area in southwest Winnipeg.

Waverley West is approximately 3,000 acres (370 ha) of mostly undeveloped land, bounded by Bishop Grandin Boulevard (Route 165), Waverley Street (Route 80), Perimeter Highway and Brady Road (Fig. A).

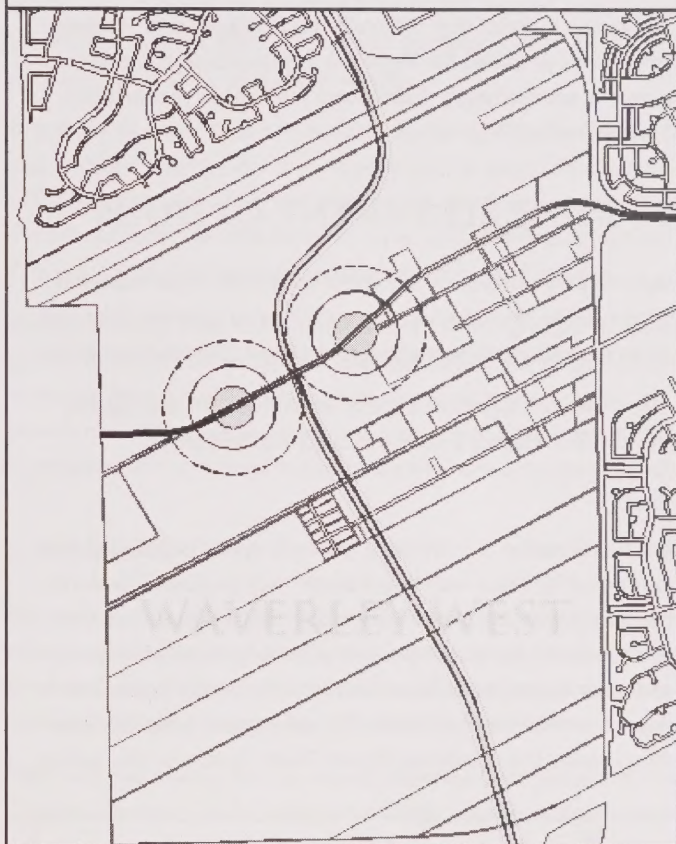
At present, Winnipeg's urban development extends to the north and east boundaries of Waverley West, which is in a desirable sector of the city. The area has available capacity in abutting major services and is ideally situated for contiguous urban development.

The predominant feature of such a development will be the integration of the southerly extension of Kenaston Boulevard (Route 90) the major north-south arterial road in the western part of the city and a key trucking route.

The city's conceptual plan for the Kenaston Boulevard extension is an expressway-class facility extending south to the Perimeter Highway. The city views it as a key transportation route for passenger and truck traffic and projects that it will accommodate around 100,000 vehicles a day.

Manitoba Housing, in association with the Canada Mortgage and Housing Corporation (CMHC), wished to assess the traffic performance of options for Kenaston Boulevard as it passes through a town centre in the northern sector of the proposed development. CMHC advocates a holistic view of sustainable community development which includes livability, economic viability, low environmental impact and affordability. From this perspective, the research question was whether regional arterials can inject vitality and vibrancy to a new community while enhancing the pedestrian environment and while fulfilling their transportation function adequately.

Figure A: The Waverley West site and the southerly extension of Kenaston boulevard



Five options for Kenaston Boulevard alignment were prepared by MHRC with an objective of changing the dynamics from the traditional suburban development form in Winnipeg. The concepts incorporate pedestrian-friendly, New Urbanism techniques to foster greater live-work-buy-play opportunities within the community with a corresponding decrease in both internal and external traffic. The intent is to create a more livable and healthy community that lessens development impacts on the city and on the environment.

LAND USE CONCEPT

The general development concept for Waverley West features two proposed “town centre” concentrations, at the intersections of Kenaston Boulevard at the westerly extensions of Bison Drive (North Town Centre) and Waverley Street (South Town Centre). Each Town Centre comprises of a 50-acre (6-ha) core commercial area integrated with 170 acres (20 ha) of multiple residential development. At the North Town Centre there is an additional 100 acres (12 ha) of business park. The forecast housing yields are 10 dwelling units per acre for multiple residential and five dwelling units per acre for single-family residential.

Based on these densities, it is estimated that there will be 6,650 single-family dwelling units and 3,320 multiple family dwelling units—a total of 9,970—in Waverley West.

It is within this context that the traffic performance was assessed for five options prepared for Kenaston Boulevard, with specific focus on the approximately 1,200 acres (148 ha) in the northern sector of Waverley West.

KENASTON ALIGNMENT OPTIONS

For each Kenaston Boulevard alignment option the major roadways were assumed to have the necessary number of through-lanes and turn lanes to meet capacity demands to maximum practical lane limits.

The five Kenaston Alignment options in the North Town Centre are illustrated in Figures B to F and described as follows:

Option 1

In Option 1, Kenaston is an 80-km/h (50-mph) speed limit expressway through Waverley West with two internal intersections. The north intersection is with the proposed westerly Bison Drive extension and the south intersection with a westerly realignment of Waverley Street. In this option, both Bison Drive and Waverley Street are considered arterials with 60 km/h (35 mph) speed limits. Because Kenaston severs the envisioned North Town Centre, in this option

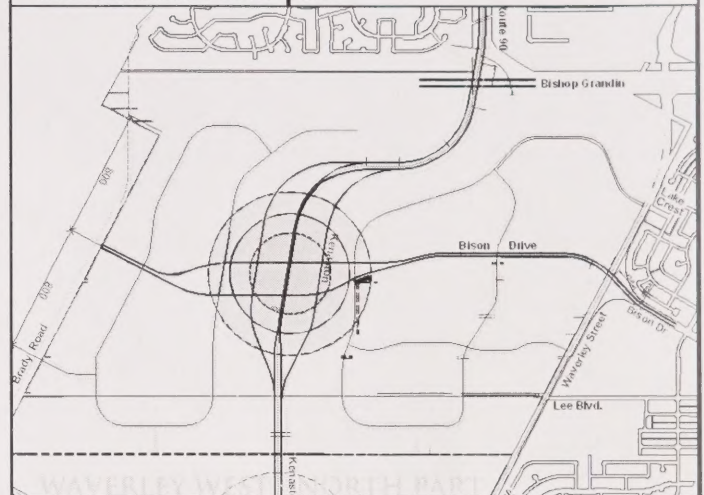
land use on each side of Kenaston is evenly split to form two town-centre clusters. This configuration results in one intersection in the North Town Centre area (Fig. A).

Option 2

In Option 2, both Kenaston and Bison are split into one-way pairs in the vicinity of the Town Centre, with 200-m spacing between one-way roadways (Fig. B). The core of the Town Centre is situated in the 200 m x 200 m separation area and all four roadways have 60 km/h speed limits in the vicinity of the Town Centre. Parking is not permitted on Kenaston.

This configuration results in four intersections in the Town Centre area, all on the Kenaston one-way pair.

Figure C: A “main street” is inserted between the Kenaston blvd pair



Option 3

This option adds a Town Centre “main street” to option 2. It is inserted halfway between the Kenaston pair to provide a 400-m (440-yd.) separation between the pair (Fig. C). The Bison one-way pair maintains a 200-m (220-yd.) separation. “Main Street” is considered an extension of Kenaston, with a 50-km/h (30-mph) speed limit and on-street parking, while the Kenaston one-way roads are considered bypass routes with 60 km/h (40 mph) speed limits and no on-street parking. The Bison one-way pair has a 60 km/h speed limit, but on-street parking is permitted.

This configuration results in a total of six intersections of major streets in the Town Centre area, four of which are on the Kenaston one-way pair.

Option 4

This option adds an east–west collector street parallel and 200 m the north of the west-bound Bison roadway to the previous options (Fig. D). The collector speed limit is 50 km/h with on-street parking permitted. All other speed limits and parking constraints are the same as Option 3. This configuration results in nine intersections of major streets in the Town Centre area, six on the Kenaston one-way pair.

Figure B: Kenaston and Bison are split into one-way pairs at the town centre

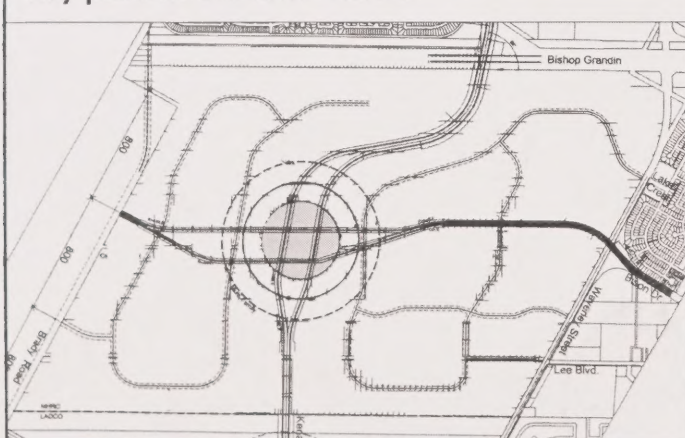
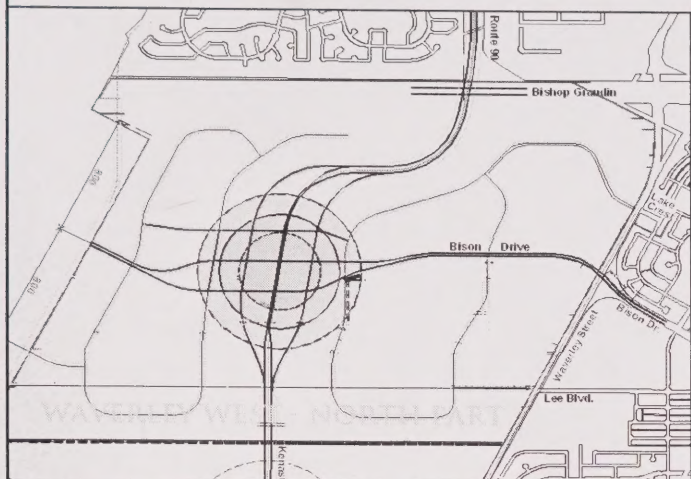


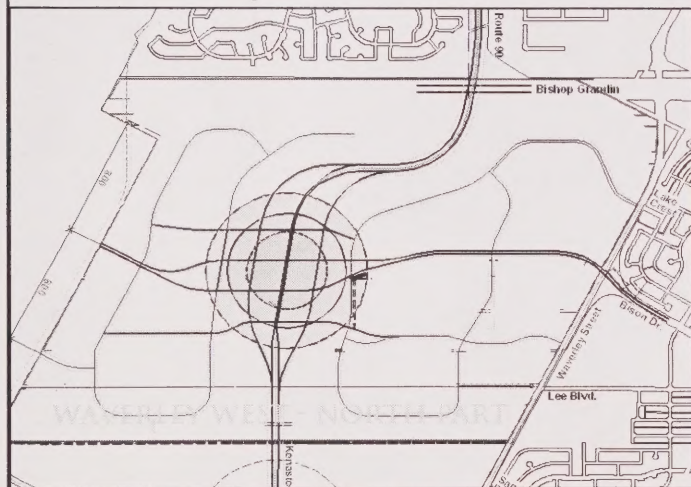
Figure D: A collector is added north of Bison Drive pair



Option 5

Option 5 adds east-west collectors parallel and 200 m to the north and south, respectively, of the Bison one-way pair, to Option 4 (Fig. E). Both collectors have 50 km/h speed limits with on-street parking permitted. All other speed limits and parking constraints are the

Figure E: A second collector is added south of the Bison Drive pair.



same as in Option 4.

This configuration results in a total of 12 intersections of major streets in the Town Centre area, eight on the Kenaston one-way pair.

TRAFFIC GENERATION

The major streets of Waverley West will be affected by traffic from within the development as well as background traffic passing through. It was assumed that the traffic will grow at an average annual rate of 2.5 per cent during the 30-year development period of Waverley West with route performance projected for a 2035 fully developed community.

The Institute of Traffic Engineers Trip generation manual was used to estimate critical peak-hour (PM) traffic generation rates per acre for the various land uses of the concept plan.

The predicted traffic was reduced by the capture rate, a factor which identifies the percentage of trips generated inside a development that remain internal.

Higher use of public transit also reduces external vehicular trips. The capture rate can be expected to increase if the nature of the development is such that live-work-buy-play needs of the community are met internally at a higher-than-normal rate. This results in more pedestrian trips and fewer external vehicular trips. Capture rate of eight per cent was used based on a review of the highest documented City of Winnipeg rates. More optimistic capture rates have been projected for similar developments in other locations, but actual results are still to be demonstrated. Aggressive capture rates should be tempered by the effects of climatic conditions, overall city development and transportation trends.

Based on city traffic data, a forecast of background traffic that would pass through Waverley West was projected for the target 2035 build-out year. Using the city's *Travel and demographic trends* report as a guide, the forecast traffic was distributed on a percentage basis as to direction. This was then used to assign volumes to specific major routes.

Variations in the base traffic assumptions for background volumes, growth rate and internal capture rate could affect the analysis results. Increases from assumed values for background traffic volume and growth rate will have a negative impact on overall performance, while an increase in the internal capture rate will have a positive impact.

ANALYSIS

The performance of the alignment options was analysed using accepted transportation planning methods and computer tools. These methods produced data on route and intersection levels of service, travel time, fuel consumption and carbon monoxide emissions.

With only two intersections to service Waverley West between Bishop Grandin Boulevard and the Perimeter Highway, the single at-grade intersection at the North Town Centre (Option 1) does not provide sufficient capacity for the forecast traffic volumes. By separating the directional roadways of Kenaston Boulevard and Bison Drive into one-way pairs (Option 2), the Town Centre area intersection capacity is only marginally improved, but not to acceptable levels of service.

By adding a "Main Street" between the Kenaston Boulevard one-way pairs (Option 3), volumes and turning movements can be reduced along Kenaston Boulevard, resulting in improved capacity and levels of service. However, the levels of service are still below acceptable standards.

With the addition of the north Collector (Option 4), the six intersections on the one-way pairs provides only a marginal increase along Kenaston Boulevard but does improve the left-turn movements, as well as providing better access to the north end of the development. However, one intersection still does not meet the acceptable levels of service.

When the south Collector (Option 5) is added with a total of eight intersections on the one-way pairs, the levels of service meet or exceed the minimum acceptable levels on all intersections.

For Option 5 the analysis showed the PM peak-hour travel time between Bishop Grandin Boulevard and the Perimeter Highway as 9.5 minutes southbound and 4.8 minutes northbound. While similar outputs were produced for the other options, they were judged irrelevant because the options did not meet level of service criteria.

DISCUSSION

The adopted planning concept for above average live-work-shop-play opportunities in Waverley West is beneficial. Without the resulting higher internal traffic capture rate, the forecast traffic volumes on Kenaston Boulevard and other related major routes would be higher.

One-way pairs create fewer turning-movement conflicts at each intersection compared to a single all-directional intersection accommodating all movements. The one-way pairs result in improved through-traffic capacity by increased green-signal time due to the reduction in the number of conflicts (no oncoming traffic). The signal timing for closely spaced intersections in one direction can be synchronized to optimize traffic platooning for through traffic, while providing the required capacity for the left-turning movements.

The progression from Options 2 to 5 shows a steady rise in intersection levels of service to the point that, with Option 5, all intersections met or exceeded the minimum acceptable level of service. Thus a key function of Kenaston Boulevard—providing access to the northern sector of Waverley West—would be fully met by Option 5. Fulfilling this function also means that Kenaston would enhance the vitality of the town centre district and its pedestrian character thus also meeting a key quality of life objective of the new community.

However, the additional function of the Boulevard, that of a primary north-south arterial route in west Winnipeg, which is considered by the city as the central one, will be negatively affected by the number of at-grade intersections required for Option 5, even with the benefits of one-way pairs, close spacing and signal synchronization.

It is thus expected that the functional objectives of Kenaston Boulevard as currently understood and projected would be better served if the at-grade intersections of Option 5 were replaced by a "split diamond" interchange. This replacement is expected to reduce travel time by 30 per cent, with associated improvements in safety, productivity, fuel consumption and emissions.

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Housing Research at CMHC

Under Part IX of the *National Housing Act*, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

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